CLAIMS

1. An atrioventricular replacement valve, comprising:

a valve body having an inlet portion comprising an annulus and an outlet portion having at least two commissural attachment locations, said annulus having a periphery, the edges of said periphery being scalloped, wherein said annulus has a saddle-shaped periphery formed by a pair of relatively high peripheral portions separated by a pair of relatively low peripheral portions.

2. The valve of Claim 1, wherein one of the high peripheral portions is higher than the other of the high peripheral portions.

3. The valve of Claim 2, wherein the annulus has an annulus tilt angle in the range of 12-20 degrees.

4. The valve of Claim 3, wherein the annulus has a shape which is non-circular when viewed in a direction perpendicular to the plane of the annulus.

5. The valve of Claim 4, wherein said non-circular shape is generally an oval shape.

6. The valve of Claim 5, wherein said oval shape has a major axis extending between the low portions and a minor axis extending between the high portions.

7. The valve of Claim 6, wherein said oval shape is asymmetric with respect to at least one of said major and minor axes.

8. The valve of Claim 7, wherein the annulus has a generally ovoid shape.

9. The valve of Claim 6, wherein said oval shape is symmetric with respect to said minor axis.

10. The valve of Claim 1, wherein the edges of the outlet portion are scalloped.

11. The valve of Claim 10, wherein the scallops comprise longitudinally extending portions that are aligned with the low portions of the annulus, said extending portions having said commissural attachment locations.

12. The valve of Claim 1, wherein said valve body comprises a pair of hinge lines at which said body preferentially bends to form an anterior leaflet and a posterior leaflet.

13. The valve of Claim 12, wherein the hinge lines are disposed so that at least the portion of the anterior leaflet adjacent said annulus subtends significantly less than 180° of said annulus.

14. The valve of Claim 12, wherein the hinge lines are formed by respective seams extending longitudinally along the valve body.

15. The valve of Claim 14, wherein the seams are formed by stitching an interior side of the posterior leaflet in facing relationship with an interior side of the anterior leaflet, whereby said seams provide a slight biasing of the leaflets towards each other to aid in closing of the valve, without significantly restricting fluid flow from the annulus through the valve body when the valve is open.

16. The valve of Claim 12, wherein the hinge lines are disposed such that, upon closure of the valve, the commissural line between the leaflets is curved substantially towards the

anterior side of the valve, whereby the anterior leaflet forms a trough through which blood flows from the ventricle to the aorta,

17. An atrioventricular replacement valve, comprising:

a valve body having an inlet portion comprising an annulus and an outlet portion having at least two commissural attachment locations, said annulus having an annulus tilt angle in the range of about 5-20 degrees.

18. The valve of Claim 17, wherein the annulus tilt angle is in the range of about 10-15 degrees.

19. The valve of Claim 17, wherein the annulus tilt angle is about 12-13 degrees.

20. The valve of Claim 17, wherein said valve body comprises leaflets which meet along first and second hinge lines such that a plane passing through (1) said hinge lines at said annulus and (2) at least one of said commissural attachment locations intersects a longitudinal axis of the valve.

21. The valve of Claim 20, wherein the hinge lines at the annulus and the commissural attachment locations are substantially planar.

22. A replacement mitral valve, comprising:

a valve body having an inlet and an outlet, said body including an annulus at said inlet for attachment to a native tissue annulus, said body comprised of an anterior leaflet and a posterior leaflet which meet along first and second hinge lines extending substantially from the annulus at the inlet towards the outlet;

each of said hinge lines at the annulus being disposed more than 60° and less than 90° from the midpoint of the anterior leaflet at the annulus.

23. The valve of Claim 20, wherein said hinge lines at said annulus are disposed about 70-80° from the midpoint of the anterior leaflet at the annulus.

24. The valve of Claim 22, wherein at least one of the hinge lines at the outlet is disposed less than 90° from the midpoint of the posterior leaflet at the outlet.

25. The valve of Claim 24, wherein the hinge lines at the outlet are disposed less than 90° from the midpoint of the posterior leaflet at the outlet.

26. An atrioventricular replacement valve, comprising:

a valve body having a longitudinal axis, said body including an inlet and an outlet, said body comprised of two leaflets which meet along first and second hinge lines extending substantially between the inlet and outlet, said first and second hinge lines at said inlet passing through a first plane which extends in a direction parallel to said longitudinal axis, said first and second hinge lines at said outlet passing through a second plane which extends in a direction parallel to said longitudinal axis, said first and second planes intersecting at an angle.

27. The valve of Claim 26, wherein the angle of intersection of said planes is at least 2 degrees.

28. The valve of Claim 26, wherein the angle of intersection of said planes is about 5-6°.

29. A replacement atrioventricular valve comprising:

a tubular member having an inlet and an outlet, an anterior side of said member having a length between the inlet and outlet which is longer than that of a posterior side of said member.

30. A method of manufacturing a replacement atrioventricular valve, comprising:

providing a sheet of tissue; and

cutting an anterior leaflet and a posterior leaflet from said tissue, said cutting comprising cutting an inflow end of the anterior leaflet on a radius of curvature different than that of an inflow end of the posterior leaflet.

31. A surgical method, comprising:

providing a replacement atrioventricular valve having an inlet and an outlet, said valve comprising a tubular member having a longitudinal axis, a first direction along said axis extending from the inlet to the outlet, a second direction along said axis extending from the outlet to the inlet, said valve comprised of a saddle-shaped annulus having an anterior saddle portion which extends further in said second direction than a posterior saddle portion of said annulus, said posterior saddle portion extending further in the second direction than intermediate saddle portions between the anterior and posterior saddle portions;

attaching said annulus to a native tissue annulus with said anterior saddle portion abutting at least a portion of the fibrous trigon.

32. A method, comprising:

providing an atrioventricular valve having a saddle-shaped annulus;

testing said atrioventricular valve by placing said annulus in a seat having a shape complementary to the saddle-shaped annulus such that the annulus seals to the seat;

said testing further comprising delivering a pulsating flow of fluid through the valve.

33. An atrioventricular replacement valve, comprising:

a valve body having an inlet, an outlet, an anterior leaflet and a posterior leaflet, the leaflets connected to each other along hinge lines that extend from the inlet to the outlet;

a first direction being defined generally from the inlet to the outlet along a longitudinal axis of the valve body, and a second direction being defined along the longitudinal axis generally opposite the first direction;

wherein the leaflets are scalloped at the outlet so that a distance in the second direction between the midpoints of each of the leaflets at the outlet and the hinge lines at the outlet is less than 4mm.

34. The valve of Claim 33, wherein the distance is between about 1-3mm.

35. A method of manufacturing a replacement heart valve, comprising:

providing a first leaflet and a second leaflet, each leaflet comprising a distally-extending tab portion;

providing a connector member;

connecting the tab portion of the first leaflet to the connector member; and

connecting the tab portion of the second leaflet to the connector member.

36. The method of Claim 35, wherein the first and second tab portion attached to the connector member collectively comprise a commissural tab of the valve.